

next sections he gives a theory of the propeller, while chap. 8 deals with the problem of the aeroplane in moving air. Following Prof. E. B. Wilson the treatment is based on the study of forced oscillations, but the reader will do well to follow Dr. Brodetsky's advice and read his alternative treatment by the method of initial motions. This latter method, by the way, opens up an almost unlimited supply of calculable problems which cannot fail to throw light on questions regarding design and control of aircraft which are under the direction of their pilots.¹

A further important innovation is the insertion of collections of exercises, commonly described as "Examples." Here again Dr. Brodetsky has had the difficult task of striking out in a new line in incorporating the features of a Cambridge text-book in an aeronautical treatise. This feature will, we hope, be of great use in making the present important developments of applied mathematics available in our honours schools.

A further contribution to the study of aeroplane mathematics by Dr. Brodetsky appeared in the *Mathematical Gazette* for May 1921. It dealt mainly with the conditions of equilibrium of the forces acting on an aeroplane in steady motion of different types, such as horizontal flight, climbing, descending, gliding with or without varying the elevator, diving and upside-down flight, load variations, variation of air density with altitude, flight in steady wind, and circling and helical flights with and without sideslip. In conclusion Dr. Brodetsky remarked: "The present paper will perhaps suffice as an indication to teachers of mathematics and others of how much really useful and interesting information can be obtained with easy mathematics. The introduction of aeroplane mathematics into ordinary courses in all our schools and universities would be a great boon to teachers as well as to pupils."

In addition to strongly supporting Dr. Brodetsky's plea for the study of aeroplane problems by mathematicians and their pupils, we would refer to the equally important task which remains, of equipping the workers in the aeroplane industry with a better knowledge of the principles of mechanics involved in aircraft construction and manipulation. In this connection it is to be hoped that the Institute of Aeronautical Engineers, now two years old, will prove a valuable addition to the roll of similar technical

and professional institutes that have been formed in nearly every other branch of applied science, the ranks of which are largely recruited from the students of our technical colleges and universities. For such students Dr. Brodetsky's book is specially suitable.

G. H. BRYAN.

The History of Whaling.

A History of the Whale Fisheries: From the Basque Fisheries of the Tenth Century to the Hunting of the Finner Whale at the Present Date. By Dr. J. T. Jenkins. Pp. 336. (London: H. F. and G. Witherby, 1921.) 18s.

AT the close of the last century whaling appeared likely to terminate at an early date, in view of the great reduction in the numbers of whales which had been brought about by a relentless and long-continued persecution. The rate of destruction had been accelerated by the introduction of modern methods, and if new fields had not been discovered whaling might by now be almost a thing of the past. Dr. Jenkins's book contains a large amount of information which will be of great value to those who wish to satisfy themselves whether the lessons of history confirm the forebodings which have been expressed about the future of whales.

The work opens with an account of whales, their species, habits and migrations, and zoologists may turn with interest to an Icelandic classification (p. 87) of 1777, which within its limits is not inferior to the most modern system, or to the excellent account of the Greenland whale (p. 116) given by Edge, who took part in Arctic whaling in 1610. The next chapter deals with the products of whales, the method of hunting, and whaling legislation, giving also a brief review of the successive phases of the industry, a subject which is considered in greater detail in later chapters. Whale-oil, a material which was formerly indispensable for the lighting of houses, public buildings, and streets, has remained one of the most important raw materials for the manufacture of soap and glycerine, the great quantities of glycerine which were extracted from it during the war having been of vital importance to this country. Spermaceti, ambergris, and whale-bone are still highly valued materials, while the greater part of the carcasses of whales is utilised in the preparation of agricultural manure, the flesh being partly converted into cattle-foods or even used for human consumption.

The first known account of whaling is that of Ochther, who voyaged beyond the North Cape towards the end of the ninth century, and afterwards described

¹ The investigations which the writer of this review was able to initiate and undertake with the assistance of a three-years grant from the Research Department could not for various reasons be incorporated in Dr. Brodetsky's treatise, but have been published in the Reports and Memoranda of the Advisory Committee for Aeronautics and the Aeronautical Research Committee, Nos. 555, 640, 684, 689, and 744, the last two dealing with the general equations of motion of aeroplanes studied from several novel points of view with the use of Brodetsky's notation. The last Report constitutes a brief exposition of the general theory of initial motions in its application to aeroplanes.

his journey to King Alfred (p. 59). The whale industry of the Bay of Biscay, depending principally on the Atlantic right whale, can also be traced back to an early date, since it was at its apogee in the twelfth and thirteenth centuries (p. 61). The Basques appear to have voyaged to Newfoundland as early as 1372 (p. 64), thus anticipating Columbus by more than a century. It will perhaps surprise the general reader to learn that train oil, a name derived from the Dutch *traan*, a tear or drop, is mentioned as a material "to the great commodity and benefit of this our Realm of England," in a grant by Queen Elizabeth, 1576-7 (p. 303).

For nearly three centuries the Greenland whale occupied a position of special importance in the industry, at first in the neighbourhood of Spitsbergen (from about 1604), later in Davis Straits (from 1718), and in the North Pacific and the Arctic Ocean beyond Bering Straits still later (from 1846). The sperm whale industry had meanwhile become so important as to rival that based on the Greenland whale, starting off New England about 1614 (p. 223), and afterwards extending into the Atlantic, Pacific, and Indian Oceans. The Pacific grey whale was hunted for a relatively short period off the coast of California, an original method of capture having previously been invented by the Indians. The operations off Iceland, Newfoundland, Japan, the British coasts (on a larger scale than is generally recognised), and Spain are described in the concluding chapter, which also deals with the specially important modern development of whaling, carried on since 1905 in the neighbourhood of the Antarctic continent, as well as off the coasts of South Africa and South America. This subject, of urgent public interest, deserved fuller treatment.

Dr. Jenkins does not sufficiently emphasise in his work the deplorable reduction in the number of humpbacks within five or six years from the commencement of operations off South Georgia, and he seems to regard this species as still very common off the South African coasts (pp. 295, 296). In suggesting a winter Antarctic close season (p. 299) he is not up to date, as this measure has recently been authorised by the Colonial Office, while the list of the chief existing southern whaling areas on p. 292 gives no hint of the predominance of South Georgia and the South Shetlands, nor does it indicate that whaling operations in the South Orkneys, Australia, Kerguelen, and other localities are extinct or of negligible importance. It would scarcely be inferred from the account of the African stations how great has been the shrinkage of the industry within the last decade. The impoverishment of the natural resources of the world due to the operations of the whalers, and obvious from their own records, might have been explained with

greater emphasis. The statement (p. 234) that the discovery of petroleum in 1859 sealed the fate of American whaling can scarcely be described as the only cause, for the diminution in the number of whales which was taking place must have had some influence in producing this result.

It is melancholy to compare the existing distribution of whales with their former abundance. The Greenland whale occurred in profusion in the bays of Spitsbergen at the commencement of Arctic whaling, and the Varanger Fjord during March "simply bubbles or boils" with humpbacks (p. 32). Atlantic right whales regularly passed Biarritz towards the end of the seventeenth century (p. 64), while whales were plentiful off New England in 1614, where an early writer speaks of "mighty whales spewing up water in the air like the smoke of a chimney, of such incredible bigness that I will never wonder that the body of Jonah could be in the belly of a whale" (p. 223). These occurrences are now mostly things of the past and though Dr. Jenkins fully recognises the fact, he is perhaps not sufficiently convinced of the danger of extinction.

The production of whale-oil is usually estimated in barrels, and some discussion of the capacity of this measure would have been useful. The book must be read carefully to discover a reference (p. 244) to barrels of thirty gallons each and a statement (p. 293) that the standard size is now six barrels of oil to one ton. On p. 294 the question is unnecessarily complicated by giving the oil production for Natal in pounds for 1909, in barrels and tons for 1910, and in pounds for British South Africa, 1910. Scoresby (1820) had already stated that the ton consisted of 252 gallons, and had given experimental estimations of the number of pounds of oil to the gallon at different temperatures; from his remarks, however, on the gauging of casks and from his list of stores, where he says that the casks should be of sizes suitable for stowage, it is obvious that the barrel was not a definite measure. There is probably considerable uncertainty as to the extent of a catch estimated as so many barrels of oil.

The figures given by Dr. Jenkins occasionally arouse doubts as to their accuracy, as on p. 268, from which it would appear that, after deducting the value of the baleen, a blue whale is worth 90*l.* and the smaller fin whale 110*l.* In other cases sufficient care has not been taken to explain that a statement is no longer correct, as in the account (p. 29) of the Pacific grey whale, which has ceased to be common on the coast of California. Exception may also be taken to p. 265, representing the facilitation of the capture of the smaller whales as the principal result of the introduction of Svend Foyn's harpoon-gun. The statement (p. 293) that whalebone is worth from 39*l.* to 45*l.* a ton is

ambiguous, since the list to which it refers includes not only the Rorquals, but also the Greenland whale. It appears from another page that the whalebone of the Greenland whale fetched 1250*l.* a ton in 1901, and even this falls far short of the highest price it is known to have reached.

Some points might have been brought out more clearly by relegating details to tables in which one year could easily have been compared with another. By setting these facts out at length in his main narrative the author has failed, to some extent, to give a correct perspective of the general trend of events. There can be no doubt that whales have diminished in number, and Dr. Jenkins's book will do real service if, by calling attention to the history of the past, it awakens interest in the urgent necessity of so regulating the industry as to avoid the disaster of completing the destruction of animals which must rank as among the most wonderful of mammals. The book contains much information extracted from State papers and other old records at home and abroad, special attention having been given to the Dutch whaling literature. Many of these documents are so inaccessible that the gratitude of zoologists is due to Dr. Jenkins for this service.

Inorganic Chemistry as a Science.

Handbuch der anorganischen Chemie in vier Bänden

Edited by Prof. R. Abegg and Dr. Fr. Auerbach.

Vierter Band. *Erste Abteilung, zweite Hälfte. Die Elemente der sechsten Gruppe des periodischen Systems.*

Zweite Hälfte. Edited by Dr. Fr. Auerbach. Pp. xiii + 1072. (Leipzig: S. Hirzel, 1921.) 140 marks.

ALL chemists will rejoice at the appearance of another volume of the well-known Abegg-Auerbach "Handbook of Inorganic Chemistry," and we desire to offer Dr. Fr. Auerbach our hearty congratulations on his success in carrying on so worthily the great work begun by Abegg. The last volume, dealing with F, Cl, Br, I, and Mn, appeared in 1913. As the editor states in the preface, the appearance of the present volume has been delayed by the European war. It deals with the elements Cr, Mo, W, and U, which belong to the sixth group of the periodic table. It is intended that O, S, Se, and Te shall be dealt with in a later volume.

The authorship of the monographs contained in the present volume is as follows: Chromium, Molybdenum, and Tungsten, J. Koppel; Uranium, R. J. Meyer; Hetero-poly-acids, A. Rosenheim.

The famous writer of the articles on atomic weights in the previous volumes—Brauner—has now dropped

out and his place is taken by J. Meyer. Similarly we miss the name of Lottermoser in connection with the articles dealing with colloid chemistry, these being now written by G. Jander.

A very important part of the volume under review is the extensive monograph by Rosenheim on the hetero-poly-acids and their salts. Although the corresponding complex anions may be derived from elements other than those dealt with in this volume, these compounds have been treated as a single group and included in the present volume, since molybdenum and tungsten are amongst the constituents which occur most frequently in these anionic complexes. This is a happy idea and a most useful one, for the monograph by Rosenheim is probably the first really comprehensive and satisfactory survey of this difficult subject that has appeared.

Of the 1064 pages (omitting the subject index) in the present volume, 465 are occupied by the article on chromium. This is undoubtedly one of the finest chemical monographs ever written and must have cost the author an immense amount of thought, labour, and time. We all owe him a great debt of thanks for his splendid work. Attention may be directed specially to his exhaustive treatment of the complex chromi-ammines (which alone occupies eighty-two pages), the anionic chromi-complexes, the passivity and "electromotive" behaviour of chromium, and the heterogeneous equilibria in which chromium compounds are involved.

Under tungsten there is an excellent account of the tungsten filament lamp and the methods of preparing and treating metallic tungsten, while the monograph on uranium and its compounds by R. J. Meyer contains a very good account of the physical chemistry of the uranyl compounds.

But where everything is so good, it is difficult to select any special part for particular mention. Thus the articles on atomic weights and on colloid chemistry by J. Meyer and G. Jander respectively appear to be quite up to the high standard set in previous volumes. We can give the present volume no higher praise than to say that it would have rejoiced the heart of Abegg. Of the great "Handbook" it can still be said that it must be in the possession of, or readily accessible to, every scientific chemist, whatever may be his special occupation or province of work. It constitutes a re-writing of inorganic chemistry on the basis of the pioneer work of Mendeléeff, Gibbs, Rooseboom, Thomson, Arrhenius, van't Hoff, Ostwald, Nernst, Abegg, Bodländer and Werner. It does for the present generation what the great work of Gmelin did for a previous one. It utilises thermodynamics and the theory of ions in carrying inorganic chemistry another